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SURFACE-WATER MONITORING PROGRAM
ROCKY MOUNTAIN ARSENAL
TASK PLAN 1995

October 1994

DRAFT FINAL

U.S. GEOLOGICAL SURVEY
WATER RESOURCES DIVISION
COLORADO DISTRICT RMA PROJECT OFFICE

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THE PURPOSE OF THIS TASK PLAN IS TO PRESENT AND DEFINE THE SURFACE WATER MONITORING PROGRAM (SWMP) FOR FISCAL YEAR 1995 (FY95). THE PRINCIPAL COMPONENTS OF THE SWMP ARE THE SURFACE WATER NETWORK AND OPERATIONAL METHODOLOGIES USED WITHIN THE NETWORK.

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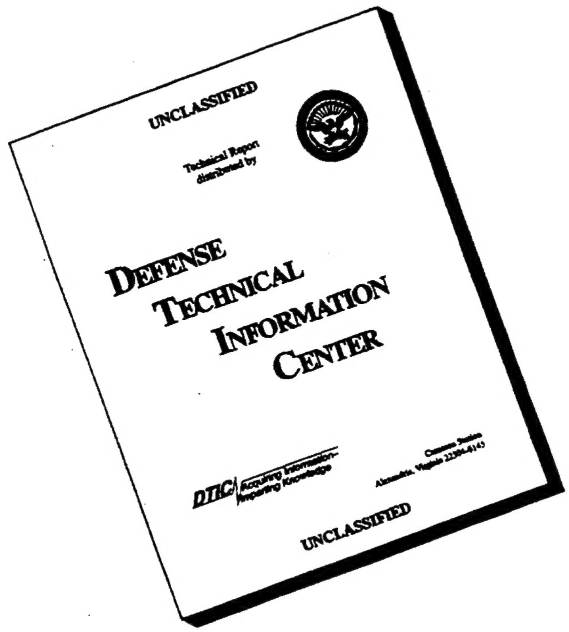

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TABLE OF CONTENTS

LIST OF ILLUSTRATIONS

LIST OF TABLES

INTRODUCTION

The Program Manager for the Rocky Mountain Arsenal (PMRMA) will conduct a technical program addressing surface-water conditions on Rocky Mountain Arsenal (RMA). The U.S. Geological Survey will perform the surface-water monitoring program (SWMP) and will develop individual aspects of the program in a logical progression. The principal goals of the surface-water program are designed to:

1. Support the needs of clean-up activities at RMA.

2. Monitor surface-water flow, storage, and quality on and around RMA.

3. Provide timely and accurate data that will be appropriate to address issues such as water balance, surface- and ground-water interaction, and water management scenarios at RMA

This core of basic data will remain a constant foundation for the program; however, the program will also be responsive to specific needs of other on-going programs such as remedial investigations, feasibility studies, and the design analysis of alternatives.

The purpose of this task plan is to present and define the SWMP for fiscal year 1995 (FY95). The principal components of the SWMP are the surface-water network and operational methodologies used within the network. Additional components of the SWMP discussed in this task plan are reports produced by the program, quality-assurance and quality-control procedures for USGS field methods and for analytical support provided by the Laboratory Support Division of the Program Manager's Office, data processing and management, and health and safety procedures used by USGS at RMA.

TECHNICAL PROGRAM

The technical program for surface water is centered about a network of surface-water gaging stations. Existing gaging stations and new gaging stations, to be established as needed, will be used to develop a network that is capable of accounting and tracking surface water on RMA. The surface-water network will also incorporate other information that is useful with respect to compiling surface-water records. Precipitation records, for instance, will be collected not only to aid in streamflow computation but also to support accounting and/or any future runoff modeling efforts.

The principal and initial function of most stations in the SWMP network will be to function as gaging stations and provide a time-series of surface-water flow in streams and storage in water bodies such as reservoirs, lakes, and ponds. Gaging stations, however, represent a sub-set of the entire SWMP network which also includes sites where water-quality samples will be collected.

Surface-water network

The names, identification numbers, and characteristics of surface-water stations in the surface-water network are given in tables 1, and 2; the network configuration is shown on plate 1 and figures 1 and 2. Changes that are being incorporated into the FY95 network are listed in table 3 and described below. During fiscal year 1994 USGS began operating a ground-water monitoring network as part of the Ground-water Monitoring Program (GMP) and wells formerly included in the SWMP for water-level monitoring are now part of the GMP (table 3).

The SWMP network includes a total of 62 surface-water stations. Thirty-four of the stations are operated as gaging stations to obtain continuous records of stage and either volume or discharge (table 1). A total of 50 sites, consisting of an additional 28 sites as well as a subset of the gaging stations, are included in the SWMP network for either scheduled or potential water-quality sampling (tables 1 and 2). Sites that are scheduled for water-quality sampling have a high priority and every effort will be made to obtain samples at sites that are scheduled for sampling. Potential sampling sites will be visited for sampling at a lower priority than scheduled sites and have usually been included in the network because they have been sampled occasionally in the past. For FY95 the SWMP network includes 18 sites that are scheduled for sampling and 32 sites that may potentially may be sampled.

At most gaging stations in the surface-water network physical structures such as weirs or flumes have been introduced into stream channels to facilitate, especially for low water conditions, water-surface elevation measurement. In order to provide coverage requisite for surface-water accounting purposes some new stations have been established and are included in the network. These stations have typically been required to define, not the amount of surface water entering or off leaving, but rather, the fate of surface water within RMA. Table 3 includes a list of stations in the current surface-water program that have been added, dropped or modified with respect to previous programs.

For FY95 two gaging stations have been added to the SWMP network (table 3). Four water-quality stations formerly scheduled for NPDES facilities sampling are now scheduled for potential sampling. All ground-water level stations formerly operated as part of the SWMP are no longer included in the SWMP and are now operated as part of the GMP.

It is anticipated that as water management practices develop and change, that there will be need for other additions and/or modifications to the surface-water network. Currently, plans are being formulated to establish methodology to measure discharge from Upper Derby to Derby Lake.

Station types and characteristics

There are currently three basic types of stations included in the surface-water network; they are:

stage-discharge stations

stage and stage-volume stations

water-quality stations

In the future some miscellaneous stations may also be established to address special or short-term phenomena. For example, in some streams existing stage-discharge stations have been sited in areas that are not likely to confine large floods in their channels. In these cases it is feasible to establish a station that would provide a record of the peak water-surface elevation in an area more likely to confine large flows. Peak-flow rates can then be estimated based on indirect techniques that employ theoretical ratings.

Stage-discharge stations

Within the surface-water program at RMA the term stage is used to indicate the elevation of a given water surface above some datum, and the term discharge is used to indicate the flow in terms of volume per unit time. Stage is measured to the nearest 0.01 foot and is, by definition, referenced to a well documented datum. The most commonly used unit used to express flow is cubic feet per second (ft^3/s). Stage-discharge stations in the surface-water network are used to define the relation between stage and discharge in a particular conveyance device, typically an open channel.

A typical gage in the surface-water network at RMA consists of a stilling well that is hydraulically connected to the stream and used to measure stage. For most perennial streams in the surface-water network a 4 foot diameter stilling well, in which stage can be directly and reliably sensed year round via a float device, has been established. In some cases, mostly those where flows are related to irrigation deliveries and freezing is not a problem, smaller diameter wells have been established and are used to sense stage. In one instance, Havana Interceptor, where it is physically difficult to construct a stilling well, stage is being sensed with a device that measures head, or water depth, as a function of pressure exerted on a stream of bubbled gas.

Stage data are recorded using an electronic data logging device that has telemetry capabilities and is referred to as a data collection platform (DCP). Detailed station descriptions are maintained for each station operated within the surface-water network.

Stage and stage-volume stations

Stage and stage-volume stations in the surface-water network are normally used to obtain records of water level in water bodies such as reservoirs, lakes, and ponds. The stage readings are used to determine volumetric content and surface area for a particular water body. The relation between stage and volumetric contents is based on the geometry of the particular water body which is typically defined through surveying techniques. Existing stage-volume and stage-area relations will be used for the present.

The same procedures used to measure stage at stage-discharge stations will be used for stage and stage-volume stations. Stilling wells for stage measurement will be located at or as close as possible to the lowest elevation in each body of water. Most stilling wells will be 0.5 feet in diameter and will be instrumented with a float device or a pressure-sensitive transducer.

Water-quality stations

Water-quality stations in the surface-water network will be used to determine physical characteristics of water and to collect samples submitted to laboratories for analysis to determine dissolved and/or total concentrations for constituents in surface water. There are 2 basic types of water-quality stations in the surface-water network; stations that are visited on fixed schedules, such as most stations listed in table 1, and stations that may potentially be sampled such as those listed on table 2. The list of potential sampling sites includes sites that, historically, have only been sampled occasionally. For instance site SW05001, a former gaging station, was regularly sampled in the past; however it is not sampled regularly now because it has been replaced by a newer gage, SW08003, that is regularly sampled. Other inclusions in the potential category are sites that may, depending on the hydrologic conditions at the time of sample collection, be redundant. For example, if water is being discharged from Havana Pond and passed through the Ladora weir it may be redundant to collect a sample immediately upstream and immediately downstream of Ladora weir.

As in the past, the main emphasis for surface-water quality sampling will concern fluids in streams and lakes. Two suites of constituents will be addressed in the program. The principal suite will consist of the RMA target list of constituents. For this year the target suite will be modified so that metals and standard constituents such as Ca, K, Mg, Na, Cl, F, and SO4 will be sampled for determination of total and dissolved concentrations. (table 4). At most water-quality stations the target list of constituents will be screened seasonally and during as many as 2 storm-runoff events (table 1). A secondary suite of constituents will be screened during storm runoff events at points where flow enters RMA (table 1), to assess water quality with respect to constituents identified in EPA regulations that address NPDES urban constituents (table 5).

A third suite of constituents addressed by the SWMP in FY94 and referred to as the NPDES facility suite is no longer addressed by the SWMP. NPDES facility sampling was formerly supported to characterize non-point contributions for selected areas on RMA in association with NPDES non-point permitting. The need for this characterization is not currently a high priority objective. The sites formerly monitored for the NPDES facility suite are now included as potential sites for the more robust target suite.

All samples collected as part of the surface-water program will include determination of the following field parameters:

water temperature

specific conductance

pH

alkalinity

dissolved oxygen

Station Operation

Stations in the surface-water network are operated according to techniques that have been developed and refined over the past several decades by USGS. A general discussion of these techniques is presented below. A much more detailed and formal presentation of these techniques is available in a series of manuals, referred to as Techniques of Water Resources Investigations (TWRI's), published by USGS beginning about the late 1960's. A list of TWRI's is presented in table 6. TWRI's are normally limited to a narrow field of subject matter; another USGS publication, Method and Computation of Streamflow (Rantz, 1982), presents a concise and well organized collective reference for techniques used by USGS to operate stations in the surface-water network.

Stage-discharge and stage-volume stations

In general, at both stage-discharge and stage-volume stations, a stage record that is referred to as continuous, but actually consists of either 5, 15, or 60 minute readings, is obtained, recorded, and transmitted to processing computers. The stage record is verified periodically by making independent physical measurements of stage using elevation control established at stage-discharge, stage, and stage-volume stations. The stability of the elevation control is normally checked annually.

At stage-discharge stations physical measurements of discharge are made at different stages to initially define and then monitor the relation between stage and discharge. This relation is often referred to as a rating curve; preliminary rating curves are normally available after about one year of data collection. Physical discharge measurements are normally made using either a Price type AA or Price Pygmy meter. A current-meter measurement is the summation of the products of the cross sectional area and average velocity for subsections of a stream cross section. Normally there are 25 to 30 subsections in a physical discharge measurement. Once a rating has been established, the frequency of measurement can sometimes be reduced to some period, usually a month, in order to define and monitor any change to the stage-discharge relation due to changes in channel characteristics. Records of stage, discharge, and volume are maintained and processed in sophisticated data processing and management systems developed, maintained, and supported by USGS; these systems are described in the data management plan.

Many stations in the surface-water network do not currently provide structures such as walkways from which high-flow discharge measurements can be made; a program to establish these facilities has been undertaken. An additional effort to establish cross-sectional geometry for channels at critical locations has also been undertaken for areas that have not previously been addressed. This information can be used to calculate theoretical ratings at most stations in the surface-water network. The theoretical ratings will be used to estimate discharge for high-flow events until conventional current meter measurements can be obtained to establish traditional stage-discharge relations.

Water-quality stations

All methods used to collect water-quality samples as part of the surface-water program conform to and are compatible with procedures that have been used in previous programs. Many of the methods used at water-quality stations to collect water samples for inorganic constituents and to determine field parameters are described in TWRIs (table 6). Additional descriptions of methods used to collect water samples for inorganic constituents are presented by Edwards and Glysson (1988). These techniques address issues such as obtaining an integrated sample from a stream or water body, proper handling of samples with respect to filtration, treatment or preservation, and shipment or storage. They do not completely address some aspects of sampling for organic constituents. A general description of the techniques that will be used with respect to sampling for organics is included in the following discussion.

In general, samples will be collected from streams or water bodies using depth-integrating techniques whenever possible. Normally 10 to 20 verticals will be used when employing depth-integrated sampling techniques. A specially modified depth-integrating sampler that utilizes teflon[1] will be used to obtain integrated samples, and any compositing will be conducted in a large glass vessel. No portion of any sample collected for analysis of organic constituents will be handled with materials other than glass or teflon.

Exceptions to depth-integrating methods will be exercised when stream depths prohibit their use, when in-stream controls such as weirs or flumes concentrate flow and provide an integrated sample, or when target constituents such as volatiles, biologic oxygen demand, or oil and grease, require that another method be used. The alternative method to depth-integrating techniques will be to dip samples directly from the stream or water body. If samples are dipped at a site where flow is concentrated by a control, such as a flume or weir, samples that could be affected by areation at the control, such as those for volatile constituents, will be dipped upstream of the control. All sampling equipment will be decontaminated using conventional materials such as sample media and de-ionized water.

[1]The use of trade or product names in this report is for identification purposes only, and does not constitute endorsement by the U.S. Geological Survey or the U.S. Army.

At most sites samples collected for determination of metals, as well as major cations and anions will be filtered so that dissolved concentrations will be reported. Samples collected at site SW24004, First Creek at the north boundary, will include determinations for both total and dissolved metals.

REPORTING

The surface-water program will produce annual reports that present all data collected as part of the program and also summarize hydrologic conditions with respect to surface water. The reporting period will coincide with the fiscal year and will be referred to as the water year. The annual data report will present all data collected as part of the SWMP, as well as data collected as part of the GMP, and will be scheduled for distribution by May 30 of the following the water year. For instance, the data report for the 1994 water year will be circulated in May of 1995. The format of the data reports will, for the most part, follow guidelines established by USGS and summarized in a USGS report (Novak, 1985) that documents the guidelines. In addition to annual presentations of data collected in the surface-water program USGS will maintain files summarizing all aspects of station operation.

An additional report that summarizes hydrologic conditions with respect to surface water will also be issued during November of the following water year on an annual basis. The hydrologic conditions addressed will include, but not necessarily be limited to, the variation and duration of streamflow and reservoir storage on RMA and a comparison of current surface-water conditions to historical conditions.

QUALITY ASSURANCE AND QUALITY CONTROL

USGS will practice quality-assurance and quality-control procedures as part of routine aspects of station operation and field methods associated with the surface-water program. These procedures will be instituted not only to improve and monitor operational methodologies but also to help correct any observed procedural problems. Guidance for quality-control and quality-assurance procedures is available from the RMA Chemical Quality Assurance Plan Version 1.0 (1993). Additional quality-assurance and quality-control procedures are institutional and are addressed in the TWRIs listed in table 6. USGS also has other means of quality assurance and control such as the National Field Quality Assurance Program (NFQAP) and internal audits.

Station operation

Most quality-assurance and quality-control procedures associated with station operations are described in detail in Rantz (1982) as well as several TWRIs (table 6). The procedures used to operate stations in the surface-water network are designed to institute systematic and time proven methodologies. These methodologies are regularly reviewed at the local level and are periodically reviewed or audited internally. Formal internal reviews occur on a 2 - 3 year period and involve a team of Regional USGS experts from appropriate disciplines to insure that proper methods are being used to operate stations and compute records. Less formal internal reviews occur annually when records are processed and prepared for publication.

Water quality

Quality-assurance and quality-control procedures associated with water-quality sampling address the performance of sampling equipment and personnel, the frequency and nature of quality-control samples, and the performance of analytical support facilities. All members of USGS staff at RMA that are involved in field operations participate in the NFQAP which was instituted by the USGS Branch of Quality Assurance in 1979. This program characterizes equipment and employee performance with respect to determination of field parameters (water temperature, pH, alkalinity, and specific conductance) on a semi-annual basis. Water-quality efforts receive the same type of internal audits or reviews exercised as part of station operations. Additional characterization of sampling methodologies is provided on the basis of quality-control samples.

The surface-water program at RMA utilizes 4 types of quality-control samples to evaluate the possibility of environmental, procedural, and institutional contamination. Environmental conditions at field sites are evaluated through samples referred to as trip and field blanks. Trip blanks are bottles filled with de-ionized water that are carried, sealed, with the a conventional sample through all phases of collection and shipping. Field blanks are sample bottles filled with de-ionized water in the field during sampling. Procedural contamination will be evaluated with equipment or rinse blanks that will be prepared by passing de-ionized water through sampling equipment after sampling and decontamination. Duplicate samples will be collected to evaluate the performance of the analytical facility and also to evaluate field procedures with respect to representativeness of the sample. Quality-control samples will be collected at a rate of 10 percent for each type of sample during scheduled sampling rounds and will be analyzed for the full suite of the sampling event, except for trip blanks, which will include only volatile constituents. Similar quality-control samples will be collected for each event sampling episode.

Analytical support

Analytical support for analysis of RMA target constituents and NPDES facility constituents will be provided through contracts administered by the Laboratory Support Division of PMRMA. Quality assurance and control procedures for this analytical support will conform to guidelines set forth in the RMA Chemical Quality Assurance Plan Version 1.0 (1993) and updates issued in June of 1991. Analytical support for NPDES urban constituents will be provided by the USGS National Water Quality Laboratory (NWQL). Quality-assurance and quality-control procedures for these analyses will conform to guidelines set forth in the USGS publication Quality Assurance/Quality Control Manual NWQL (Pritt and Raese, 1992)

DATA MANAGEMENT

The PMRMA has retained a data-management contractor to manage most data collected in association with clean-up activities at RMA. USGS has developed several data-management systems to address the large amount of stage, discharge, and water-quality data routinely collected on an agency-wide basis. Several of these systems are appropriate for reducing and/or preparing data for inclusion into the PMRMA data management contractor's data base, and some are required to manage data not addressed by the PMRMA data-management contractor. The USGS systems principally involve processing and managing data. Management systems typically address individual fields of hydrology such as surface water, ground water, and water quality. These systems, and their relation to the data-management contractor's system, are discussed below.

Data processing

At all sites collecting a continuous record within the surface-water network USGS is using a sophisticated satellite telemetry system to facilitate maintenance of records and data processing. These systems provide real-time data and also automate much of the data processing. A suite of several systems is used to receive data transmitted by satellite and convert it into a standard format that is compatible with the Automated Data Processing System (ADAPS) data-management system which has been developed and is maintained and supported by USGS. ADAPS is part of a larger system referred to as the National Water Information System (NWIS). One of the principal functions of ADAPS is to process time series data.

Another system of NWIS, the Water Quality System, is often used by USGS to process water-quality data from samples that have been analyzed, principally at the USGS NWQL. Presently, the NWQL has only limited involvement with USGS programs at RMA and USGS will rely principally on the PMRMA data management contractor's system to process water-quality data. Upon receipt of results from water-quality analyses USGS will verify the results and review the results of quality-control samples to determine if data should receive any special flagging before being passed to the data management contractor.

Data-management systems

ADAPS will also be the principal data-management system that the surface-water program will use for converting stage records to discharge and volume records and for reducing the individual or "unit" values to a single "daily" value. Daily values will be transmitted to the RMA data processing contractor concurrently with distribution of the annual data report. ADAPS is especially well suited for executing operations such as managing rating curves and performing many operations required to compile surface-water records. In addition, ADAPS is well suited for storing the large amount of data generated by surface-water programs such as the RMA program. ADAPS will also be used to store and manage time series ground-water level data.

A system referred to as Ground-Water Site Inventory (GWSI) will be the principal system used to store and manage well construction and periodic ground-water level data. Data from GWSI will be passed regularly to the PMRMA data processing contractor.

HEALTH AND SAFETY

USGS has prepared an internal Health and Safety Plan that establishes the requisite framework for conducting the surface-water program safely. The plan defines requirements and designates protocols to be followed during field activities exercised as part of the surface-water monitoring program. The plan also identifies key safety personnel, includes a risk analysis and describes safety-training programs, medical-monitoring programs, protective equipment, and emergency procedures that will be used in the surface-water monitoring program. The plan has been prepared in accordance with PMRMA's standard health and safety requirements.

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Table 1.– List of gaging stations and scheduled water-quality sampling sites in the surface-water monitoring program.

NOTE : Gaging station parameters and water quality sampling

A : at scheduled visits and sampling events B : semi-annually
C : annually D : storm events
X : continuous record P : potential
* : precipitation record

Station name	RMA id	USGS id	Gaging station parameters stage	discharge	volume	area	Water quality sampling RMA target	NPDES urban	field param-meters
Highline Lateral to Upper Derby Lake	SW010002	394845104494202	X	X			P		A
Uvalda Interceptor to Upper Derby Lake	SW010003	394845104494203	X	X			P		A
North Uvalda to Lower Derby Lake	SW01001	394845104494204	X	X			BD		A
South Plants Ditch	SW01003	394910104501900	X	X			BD		A
Upper Derby Lake	SW01004	394903104500300	X*		X	X	C		A
Derby Lake	SW01005	394858104504300	X		X	X	C		A
Sand Creek Lateral above Ladora Weir	SW020002	394856104504601	X	X			P		A
Sand Creek Lateral below Ladora Weir	SW020003	394856104504602	X	X			P		A
Ladora Ditch Below Ladora Weir	SW020004	394856104504603	X	X			BD		A
West South Plants ditch	SW020005	394922104512800	A	A			P		A
Ladora Lake Spillway	SW020012	394903104513900	X	X			P		A
Lake Mary overflow to E. Moose Pond	SW020014	394911104514400	X	X					A
Ladora Lake	SW02003	394911104513500	X		X	X	C		A
Lake Mary	SW02004	394906104515200	X		X	X	C		A
Wetland 2 flume	SW070002	394810104493100	X	X					A
Wetland 3 flume	SW070003	394826104490700	X*	X					A
Wetland 4 flume	SW070004	394828104490500	X	X					A
Wetland 5 flume	SW070005	394814104493105	X	X					A
Wetland 2	SW070006	394813104493800	X		X	X			A
Wetland 3	SW070007	394825104491700	X		X	X			A
Wetland 4	SW070008	394833104490400	X		X	X			A
Wetland 5	SW070009	394835104492200	X		X	X			A
Highline Lateral below perimeter road	SW070010	394807104485900	X	X					A
Wetland 1 flume	SW080001	394805104480400	X	X					A
Wetland 1	SW080002	394813104480900	X		X	X			A
First Creek below Buckley Road	SW08003	06720460	X*	X			BD	D	A
Sand Creek below Havana Pond	SW110001	394820104513201	X	X			P		A
Peoria Interceptor below 56th Avenue	SW11001	06720280	X*	X			BD	D	A
Havana Interceptor below 56th Avenue	SW11002	06720285	X*	X			BD	D	A
Havana Pond	SW11003	394820104513200	X		X	X	C		A
Uvalda Interceptor below 56th Avenue	SW12005	06720255	X	X			BD	D	A
Highline Lateral at 6th Avenue	SW12007	394845104494201	X	X			C		A
First Creek above 96th Avenue	SW24002	06720480	X*	X			BD		A
First Creek North RMA boundary	SW24004	395212104500900	A	A			BD		A
North Plants ditch	SW250001	395056104493800	A	A			P		A
Sand Creek Lateral at First Creek	SW250002	395922104494400	A	A			P		A
Basin F Ditch	SW26001	395110104514100	X*	X			BD		A
Toxic storage yards ditch	SW310001	395017104492200	A	A			P		A
Basin A ditch	SW36001	394922104503500	A	A			BD		A
First Creek at Highway 2	SW37001	06720490	X	X			BD		A

Table 2.– List of stations in surface-water monitoring network scheduled for potential sampling.

NOTE: Gaging-station parameters and water-quality sampling

A: at scheduled visits and samples — B: semi-annually
C: annually — D: storm events
X: continuous record

Station name	RMA id	Gaging station parameters: stage	discharge	volume	area	Water quality sampling: RMA target	NPDES facility	NPDES urban	field param-meters
South Plants Water Tower pond	SW01002					C			A
Ladora Lake Spillway	SW020012	A	A			CD			A
Sand Creek Lateral at South Plants south boundary	SW02005	A	A			CD			A
South Plants Steam Plant effluent	SW02006					C			A
Motor Pool Ditch	SW04001	A	A			CD			A
First Creek below 6th Avenue	SW05001	A	A			CD			A
First Creek above 7th Avenue	SW05002	A	A			CD			A
Upper Derby Lake overflow to First Creek	SW06002	A	A			CD			A
Tributary to Uvalda Interceptor at east culvert A	SW07001	A	A			D			A
Tributary to Uvalda Interceptor at west section 7 B	SW07002	A	A			D			A
First Creek at Buckley Road (southern entrance point)	SW08001	A	A			C			A
Highline Lateral at 56th Avenue (southern entrance point)	SW08002	A	A			C			A
Sand Creek Lateral below Havana Pond	SW110001	A	A			CD			A
East Tributary to Uvalda Interceptor	SW12001	A	A			D			A
West tributary to Uvalda Interceptor	SW12002	A	A			D			A
Storm Sewer near Army Reserve	SW12004	A	A			D			A
Army reserve ditch	SW12006	A	A			D			A
North Bog	SW24003	A	A			D			A
First Creek above North Plants tributary	SW30002	A	A			CD			A
First Creek above tributary from toxic storage yard A	SW31001	A	A			CD			A
First Creek above tributary from toxic storage yard B	SW31002	A	A			CD			A
NW South Plants tributary to First Creek	SW310003	A	A			CD			A

Table 3.– List of stations in the current surface-water program that have been added, dropped, and or have modified activities with respect to previous surface-water programs.

Station name	RMA id	Status	Rationale
Lake Mary overflow to East Moose Pond	SW020014	added	New site to obtain record of discharge from From Lake Mary
Highline Lateral below perimeter road	SW070010	added	New site to improve accounting along the Highline Lateral
West South Plant ditch	SW020005	modified	Changed from scheduled NPDES facility sample to potential sampling status
North Plants ditch	SW250001	modified	Changed from scheduled NPDES facility sample to potential sampling status
Sand Creek lateral at First Creek	SW250002	modified	Changed from scheduled NPDES facility sample to potential sampling status
Toxic storage yards ditch	SW310001	modified	Changed from scheduled NPDES facility sample to potential sampling status
All wells formerly monitored by SWMP		dropped	Dropped from SWMP and added to GMP

Table 4.– List of Rocky Mountain Arsenal target constituents addressed by the surface-water program.

Group name/constituent	Methodology/RMA name
Agent degradation products	**HPLC**
thiodiglycol	(TDGCL)
Agent degradation products	**IC**
isopropyl methylphosponic acid	(IMPA)
Metals	**ICP**
cadmium	(CD)
chromium	(CR)
copper	(CU)
lead	(PB)
zinc	(ZN)
Organophosphorous compounds	**GC/FPD**
diisopropyl methylphosphonate	(DIMP)
dimethyl methylphosphonate	(DMMP)
Semivolatile organic compounds	**GC/MS**
1,4-oxathiane	(OXAT)
2,2'bis(p-chlorophenyl)-1,1-dichloroethane	(PPDDE)
2,2'bis(p-chlorophenyl)-1,1,1-trichloroethane	(PPDDT)
aldrin	(ALDRIN)
atrazine	(ATZ)
chlordane	(CLDAN)
dibromochloropropane	(DBCP)
dicyclopentadiene	(DCPD)
dieldrin	(DLDRN)
diisopropyl methylphosphonate	(DIMP)
dimethyl methlyphosphonate	(DMMP)
dithiane	(DITH)
endrin	(ENDRIN)
hexachlorocyclopentadiene	(CL6CP)
isodrin	(ISODR)
malathion	(MLTHN)
p-chlorophenylmethyl sulfide	(CPMS)
p-chlorophenylmethyl sulfone	(CPMSO2)
p-chlorophenylmethyl sulfoxide	(CPMSO)
parathion	(PRTHN)
supona	(SUPONA)
vapona	(DDVP)
Organochlorine pesticides	**GC/ECD**
2,2'bis(p-chlorophenyl)-1,1-dichloroethane	(PPDDE)
2,2'bis(p-chlorophenyl)-1,1,1-trichloroethane	(PPDDT)
aldrin	(ALDRN)
dieldrin	(DLDRN)
endrin	(ENDRN)
hexachlorocyclopentadiene	(CL6CP)
isodrin	(ISODRN)
Organosulfur pesticides	**GC/FPD**
1,4-oxazthiane	(OXAT)
Benzothiazole	(BTZ)
p-chlorophenylmethyl sulfide	(CPMS)
p-chlorophenylmethyl sulfone	(CPMSO2)
p-chlorophenylmethyl sulfoxide	(CPMSO)
dimethyl disulfide	(DMDS)
dithiane	(DITH)
Volatile aromatic organic compounds	**GC/PID**
benzene	(C6H6)
ethylbenzene	(ETC6H5)
toluene	(MEC6H5)
m-xylene	(13DMB)
o- and p-xylene	(XYLEN)
Organophosphorous pesticides	**GC/NPD**
Atrazine	(ATZ)
Malathion	(MLTHN)
Parathion	(PRTHN)
Supona	(SUPONA)
Vapona	(DDVP)
Volatile halogenated organic compounds	**GC/CON**
1,1-dichloroethane	(11DCLE)
1,2-dichloroethane	(12DCLE)
1,1-dichloroethylene	(11DCE)
1,2-dichloroethylene (cis and trans isomers)	(12DCE)
1,1,1-trichloroethane	(111TCE)
1,1,2-trichloroethane	(112TCE)
carbon tetrachloride	(CCL4)
chlorbenzene	(CLC6H5)
chlorform	(CHCL3)
methylene chloride	(CH2CL2)
tetrachloroethylene	(TCLEE)
trichloroethylene	(TRCLE)
Volatile hydrocarbons compounds	**GC/FID**
bicyclo[2,2,1]hepta-2,5-diene	(BCHPD)
dicyclopentadiene	(DCPD)
methylisobutyl ketone	(MIBK)
arsenic	**AA** (AS)
dibromochloropropane	(DBCP) **GC/ECD**
mercury	**AA** (HG)
cyanide	**C** (CYN)
Anions	**IC**
chloride	(CL)
fluoride	(F)
sulfate	(SO4)
Cations	**ICP**
calcium	(CA)
magnesium	(MG)
sodium	(NA)
potassium	(K)
Volatile organic compounds	**GC/MS**
1,1-Dichloroethane	(11DCLE)
1,2-Dichloroethane	(12DCLE)
1,2-dichloroethylene (cis and trans isomers)	(T12DCE)
1,1,1-trichloroethane	(111TCE)
1,1,2-trichloroethane	(112TCE)
benzene	(C6H6)
bicycloheptadiene	(BCHPD)
carbon tetrachloride	(CCL4)
chlorobenzene	(CLC6H5)
chloroform	(CHCL3)
Dibromochloropropane	(DBPD)
dicyclopentadiene	(DCPD)
dimethyl disulfide	(DMDS)
ethylbenzene	(ETC6H5)
methylene chloride	(CH2CL2)
methylisobutyl ketone	(MIBK)
tetrachloroethylene	(TCLEE)
toluene	(MEC6H5)
trichloroethylene	(TRCLE)
m-xylene	(13DMB)
o- and p-xylene	(XYLEN)
nitrite/nitrate	**C** (NIT)
alkalinity	(ALK)
conductivity	(COND)
pH	(PH)
Total organic carbon	(TOC)
Dissolved organic carbon	(DOC)

AA	atomic absorption spectrometry
GC/CON	gas chromatography/conductivity detector
GC/ECD	gas chromatography/electron capture detector
GCFID	gas chromatography/flame ionazation detector
GCFPD	gas chromatography/flame photometric detector
GC/MS	gas chromatography/mass spectrometry
GC/NPD	gas chromatography/nitrogen phosphorous detector
GC/PID	gas chromatography/photoionization detector
HPLC	high performance liquid chromotography
ICP	inductively coupled argon plasma screen
IONCHROM	ion chromotography
C	Colorimetric

Table 5.-- NPDES urban constituents addressed by surface-water program

RMA NAME	LAB ABBREVIATION	LAB CODE	PARAMETER CODE	RMA NAME	LAB ABBREVIATION	LAB CODE	PARAMETER CODE
Organic constituents by GCMS-pat				**Organic constituents by GCMS-II**			
DBRM	dibromomethane	0009	30217	4CL3C	chloro-methylphenol,total	1055	34452
C6H6	benzene, total	1287	34030	2CLP	2-chlorophenol, total	1056	34586
CHBR3	bromoform, total	1288	32104	24DCLP	2,4-dichlorophenol,total	1057	34601
CCL4	carbon tetrachloride, total	1289	32102	246TCP	2,4,6-trichlorophenol,total	1058	34621
CLC6H5	chlorobenzene, total	1290	34301	24DMPN	2,4-dimethylphenol,total	1059	34606
DBRCLM	chlorodibromomethane, tot	1291	32105	46DN2C	dinitromethylphenol,total	1060	34657
C2H5CL	chloroethane, total	1292	34311	24DNP	2,4-dinitrophenol, total	1061	34616
CHCL3	chloroform, total	1294	32106	2NP	2-nitrophenol, total	1062	34591
BRDCLM	dichlorobromomethane,tot	1295	32101	4NP	4-nitrophenol, total	1063	34646
CCL2F2	dichlorodifluoromethane,t	1296	34668	PCP	pentachlorophenol, total	1064	39032
11DCLE	1,1-dichloroethane,total	1297	34496	PHENOL	phenol, total	1065	34694
12DCLE	1,2-dichloroethane,total	1298	32103	ANAPNE	acenaphthene, total	1066	34205
11DCE	1,1-dichlorethylene,total	1299	34501	ANAPYL	acenaphthylene, total	1067	34200
T12DCE	12transdicl-ethylene	1300	34546	ANTRC	anthracene, total	1068	34220
12DCLP	1,2-dichloropropane,total	1301	34541	BENZID	benzidine, total	1069	39120
ETC6H5	ethylbenzene, total	1303	34371	BAANTR	benzo(a)anthracene,total	1070	34526
CH3BR	methylbromide, total	1304	34413	BBFANT	benzo(b)fluoranthene,total	1071	34230
CH2CL2	methylene chloride,total	1305	34423	BKFANT	benzo(k)fluoranthene,total	1072	34242
TCLEA	1,1,2,2-tetrchloroethane,t	1306	34516	BAPYR	benzo(a)pyrene, total	1073	34247
TCLEE	tetrachloroethylene,total	1307	34475	BGHIPY	benzo(ghi)perylene,total	1074	34521
MEC6H5	toluene, total	1308	34010	BBZP	butyl benzyl phthalate,total	1075	34292
111TCE	1,1,1-trichloroethane,total	1309	34506	B2CEXM	2-chloreth methane,total	1076	34278
112TCE	1,1,2-trichloroethane,total	1310	34511	B2CLEE	2-chlorethyl ether,total	1077	34273
TRCLE	trichloroethylene,total	1311	39180	B2CIPE	2-chlorisopr ether,total	1078	34283
CCL3F	trichlorofluoromethane,tot	1312	3448	4BRPPE	4-bromophenylphenyl ether	1079	34636
C2H3CL	vinyl chloride, total	1313	39175	2CNAP	2-chloronaphthalene,total	1080	34581
13DCLB	1,3-dichlorobenzene,total	1315	34566	4CLPPE	4-chlorophenyl ether,total	1081	34641
14DCLB	1,4-dichlorobenzene,total	1316	34571	CHRY	chrysene, total	1082	34320
12DBRE	1,2-dibromoethane,total	1317	77651	DBAHA	dibenzanthracene, total	1083	34556
CH3CL	chloromethane, total	1318	34418	DBNP	di-n-butyl phthalate,total	1084	39110
12DCLB	1,2-dichlorobenzene,total	1320	34536	12DCLB	1,2-dichlorobenzene,total	1085	34536
C13DCP	cis13dichloropropepene, t	1326	34704	13DCLB	1,3-dichlorobenzene,total	1086	34566
T13DCP	trans13dichloropropene	1327	34699	14DCLB	1-4-dichlorobenzene,total	1087	34571
STYR	styrene	1328	77128	33DCBD	3,3-dichlorobenzidine,total	1088	34631
XYLEN	xylene, total	1330	81551	DEP	diethyl phthalate, total	1089	34336
DBCP	dibromochloropropane	1354	82625	DMP	dimethyl phthalate,total	1090	34341
11C1PE	11dichloro1propene	1478	77168	24DNT	2,4-dinitrotoluene,total	1091	34611
22DCP	22dichloropropane	1479	77170	26DNT	2,6-dinitrotoluene,total	1092	34626
13DCP	13dichloropropane	1480	77173	DNOP	di-n-octylphthalate,total	1093	34596
2CLT	12chlorotoluene	1481	77275	B2EHP	2-ethlyhexyl phthate,total	1094	39100
4CLT	14chlorotoluene	1482	77277	FLRENE	fluorene, total	1095	34381
123CPR	123trichloroproprane	1483	77443	FANT	fluoranthene, total	1096	34376
2TCLEA	1112tetrachloroethane	1484	77562	CL6BZ	hexachlorobenzene,total	1097	39700
ACROLN	acrolein wh wat rec	1650	34210	HCBD	hexachlorobutadiene,total	1098	39702
ACRYLO	acrylonitrile total	1651	34215	CL6CP	hexachlorocyclopentadiene	1099	34386
2MXMC3	methyltertbutylether	1652	78032	CL6ET	hexachloroethane, total	1100	34396
BRCLM	bromochloromethane	1654	77297	ICDPYR	indeno(1,2,3)pyrene,total	1101	34403
C12DCE	cis-12dichloroethene	1656	77093	ISOPHR	isophorone, total	1102	34408
2CLEVE	2chloroethylvinylether	1658	34576	NAP	naphthalene, total	1103	34696
ISOPBZ	isopropylbenzene	1659	77223	NB	nitrobenzene, total	1104	34447
PRC6H5	n-propylbenzene	1661	77224	NNDMEA	nitrosodimethlyamine,total	1105	34438
TBBEN	tertbutylbenzene	1663	77353	NNDPA	n-nitrosodiphenylamine,tot	1106	34433
124TMB	124-trimethylbenzene	1665	77222	NNDNPA	n-nitrosodi-n-propylamine,t	1107	34428
SBBEN	sec-butylbenzene	1667	77350	PHANTR	phenanthrene, total	1108	34461
PCYMEN	p-isopropyltoluene	1669	77356	PYR	pyrene, total	1109	34469
BUC6H5	n-butylbenzene	1671	77342	124TCB	1,2,4-trichlorobenzene,tot	1111	34551
124TCB	124-trichlorobenzene	1673	34551	12DPH	1 2-diphenylhydrazine	1697	82626
HCBD	hexachlorobutadiene	1675	39702				

Table 5.-- List of NPDES urban constituents addressed by surface-water program -- continued

RMA NAME	LAB ABBREVIATION	LAB CODE	PARAM-ETER CODE
NAP	naphthalene	1677	34696
123TCB	123-trichlorobenzene	1679	77613
TCLTFE	ethane cl3f3	1681	77652
135TMB	135 trimethylbenzene	1683	77226
BRC6H5	bromobenzene	1698	81555
Colorimetric determinations			
NH4	nitrogen ammonia, total	0123	00610
NO2	nitrogen as nitrite, total	0302	00615
NIT	nitrate + nitrite, total	0304	00630
DISP	phosphorous, dissolved	1685	00666
P4	phosphorus total	1686	00665
N2KJEL	nitrogen ammonia + organic	1688	00625
COD			
CYN	cyanide, total	0023	00720
PHENOL	phenols, total	0052	32730
Inorganic sonstituents by AA			
TL	thallium-total	1569	01059
SB	antimony-total	1646	99897
AG	silver	1647	99895
CYN	cyanide-total	1648	99896
NA	sodium, dissolved	0059	00930
CA	calcium, dissolved	0012	00915
MG	magnesium, dissolved	0040	00925
K	potassium, dissolved	0054	00935
CD	cadmium, total	0131	01027
CU	copper, total	0156	01042
PB	lead, total	0192	01051
NI	nickel, total	0198	01067
HG	mercury, total	0227	71900
BE	beryllium, total	0236	01012
CR	chromium, total	0246	01034
ZN	zinc, total	0296	01092
AG	silver, total by GFAA	1553	01077
CD	cadmium, total by GFAA	1555	01027
CU	copper, total by GFAA	1559	01042
PB	lead, total by GFAA	1561	01051
NI	nickel, total by GFAA	1563	01067
AS	arsenic, total by GFAA	1584	01002
SE	selenium, total by GFAA	1585	01147
Inorganic constituents by DCP			
CR	chromium, total	0726	01034

RMA NAME	LAB ABBREVIATION	LAB CODE	PARAM-ETER CODE
Organic constituents by GCECD			
ABHC	alpha-bhc, total	1619	39337
BBHC	beta bhc	1620	39338
LIN	gamma bhc	1621	39340
DBHC	delta bhc	1622	34259
HPCL	heptachlor	1623	39410
ALDRN	aldrin	1624	39330
HPCLE	heptachlor	1625	39420
GCLDAN	chlordan-tran	1626	39065
AENSLF	endosulfan	1627	34361
ACLDAN	chlordan-cis	1628	39062
DLDRN	dieldrin	1629	39380
PPDDE	4 4'dde	1630	39320
ENDRN	endrin	1631	39390
BENSLF	endosulfn	1632	34356
PPDDD	4 4'ddd	1633	39310
ENDRN	endrin	1634	34366
ESFSO4	endosulfansulfate	1635	34351
PPDDT	4 4'ddt	1636	39300
CLDAN	chlordane	1637	39350
TXPHEN	toxaphene	1638	39400
PCB221	aroclor-1221	1639	39488
PCB232	aroclor-1232	1640	39492
PCB016	aroclor-1016	1641	34671
PCB242	aroclor-1242	1642	39496
PCB248	aroclor-1248	1643	39500
PCB254	aroclor-1254	1644	39504
PCB260	aroclor-1260	1645	39508
physical properties			
PH	ph (laboratory)	0068	00403
COND	sp. conductance lab	0069	90095
ALK	alk total lab. caco3	0070	90410
COD	cod	0076	00340
TDS	non filterable residue	0169	00530
Inorganic constituents by IC			
SO4	sulfate dissolved by ic	1572	00945
CL	chloride dissolved by ic	1571	00940
Gravimetric determinations			
OILGR	oil and grease, total	0127	00556
Wet oxidation determinations			
TOC	carbon, organic, total	0114	00680

GCMS-pat gas chromotography mass spectrometry (purge and trap)
GCMS-II gas chromatography mass spectrometry (liquid liquid)
DCP direct current plasma
GFAA graphite furnace atomic adsorption spectrometry
GCECD gas chromatography electron capture detection
AA atomic adsorption spectrometry
IC ion chromatography

Table 6.-- List of Techniques of Water Resources Investigations published by USGS.

1-D. Water temperature--influential factors, field measurement, and data presentation, by H. H. Stevens, Jr., J. F. Ficke, and G. F. Smoot: USGS--TWRI Book 1, Chapter D1. 1975. 65 pages.

1-D2 Guidelines for collection and field analysis of ground-water samples for selected unstable constituents, by W. W. Wood: USGS--TWRI Book 1, Chapter D2. 1976. 24 pages.

3-A1. General field and office procedures for indirect discharge measurements, by M. A. Benson and Tate Dalrymple: USGS--TWRI Book 3, Chapter A1. 1967. 30 pages.

3-A2. Measurement of peak discharge by the slope-area method, by Tate Dalrymple and M. A. Benson: USGS--TWRI Book 3, Chapter A2. 1967. 12 pages.

3-A3. Measurement of peak discharge at culverts by indirect methods, by G. L. Bodhaine: USGS--TWRI Book 3, Chapter A3. 1968. 60 pages.

3-A4. Measurement of peak discharge at width contractions by indirect methods, by H. F. Matthai: USGS-TWRI Book 3, Chapter A4. 1967. 44 pages.

3-A5. Measurement of peak discharge at dams by indirect methods, by Harry Hulsing: USGS--TWRI Book 3, Chapter A5. 1967. 29 pages.

3-A6. General procedure for gaging streams, by R. W. Carter and Jacob Davidian: USGS--TWRI Book 3, Chapter A6. 1968. 13 pages.

3-A7. Stage measurements at gaging stations, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3. Chapter A7. 1968. 28 pages.

3-A8. Discharge measurements at gaging stations, by T. J. Buchanan and W. P. Somers: USGS--TWRI Book 3, Chapter A8. 1969. 65 pages.

3-A9. Measurement of time of travel in streams by dye tracing, by F. A. Kilpatrick and J. F. Wilson, Jr.: USGS--TWRI Book 3, Chapter A9. 1989. 27 pages.

3-Al0. Discharge ratings at gaging stations, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A10. 1984. 59 pages.

3-A11 Measurement of discharge by moving-boat method, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 3, Chapter A11. 1969. 22 pages.

3-A12. Flluorometric procedures for dye tracing, by J. F. Wilson, Jr., E. D. Cobb, and F. A. Kilpatrick: USGS- -TWRI Book 3, Chapter A12. 1986. 41 pages.

3-A13. Computation of continuous records of streamflow, by E. J. Kennedy: USGS--TWRI Book 3, Chapter A13. 1983. 53 pages.

Table 6.-- List of Techniques of Water Resources Investigations published by USGS, continued -

3-A14. Use of flumes in measuring discharge, by F. A. Kilpatrick and V. R. Schneider: USGS--TWRI Book 3, Chapter A14. 1983. 46 pages.

3-A15. Computation of water-surface profiles in open channels, by Jacob Davidian: USGS--TWRI Book 3, Chapter A15. 1984. 48 pages. 3-A16. Measurement of discharge using tracers, by F. A. Kilpatrick and E. D. Cobb: USGS--TWRI Book 3, Chapter A16. 1985. 52 pages.

3-A17. Acoustic velocity meter systems, by Antonius Laenen: USGS--TWRI Book 3, Chapter A17. 1985. 38 pages.

3-A18. Determination of stream reaeration coefficients by use of tracers, by F. A. Kilpatrick, R. E. Rathburn, N. Yotsukura, G. W. Parker, and L. L. DeLong: USGS--TWRI Book 3, Chapter A18. 1989. 52 pages.

3-A19. Levels of streamflow gaging stations, by E.J. Kennedy: USGS--TWRI Book 3, Chapter A19. 1990. 27 pages.

3-C1. Fluvial sediment concepts, by H. P. Guy: USGS--TWRI Book 3, Chapter C1. 1970. 55 pages.

3-C2. Field methods for measurement of fluvial sediment, by H. P. Guy and V. W. Norman: USGS--TWRI Book 3, Chapter C2. 1970. 59 pages.

3-C3. Computation of fluvial-sediment discharge, by George Porterfield: USGS--TWRI Book 3, Chapter C3. 1972. 66 pages.

4-A1. Some statistical tools in hydrology, by H. C. Riggs: USGS--TWRI Book 4, Chapter A1. 1968. 39 pages.

4-A2. Frequency curves, by H. C. Riggs: USGS--TWRI Book 4, Chapter A2. 1968. 15 pages.

4-B1. Low-flow investigations, by H. C. Riggs: USGS--TWRI Book 4, Chapter B1. 1972. 18 pages.

4-B2. Storage analyses for water supply, by H. C. Riggs and C. H. Hardison: USGS--TWRI Book 4, Chapter B2. 1973. 20 pages.

4-B3. Regional analyses of streamflow characteristics, by H. C. Riggs: USGS--TWRI Book 4, Chapter B3. 1973. 15 pages.

4-D1. Computation of rate and volume of stream depletion by wells, by C. T. Jenkins: USGS--TWRI Book 4, Chapter D1. 1970. 17 pages.

5-A1. Methods for determination of inorganic substances in water and fluvial sediments, by M. J. Fishman and L. C. Friedman: USGS--TWRI Book 5,Chapter A1. 1989. 545 pages.

5-A2. Determination of minor elements in water by emission spectroscopy, by P. R. Barnett and E. C. Mallory, Jr.: USGS--TWRI Book 5, Chapter A2. 1971. 31 pages.

Table 6.-- List of Techniques of Water Resources Investigations published by USGS, continued -

5-A3. Methods for the determination of organic substances in water and fluvial sediments, edited by R. L. Wershaw, M. J. Fishman, R. R. Grabbe, and L. E. Lowe: USGS--TWRI Book 5, Chapter A3. 1987. 80 pages.

5-A4. Methods for collection and analysis of aquatic biological and microbiological samples, by L. J. Britton and P. E. Greeson, editors: USGS--TWRI Book 5, Chapter A4. 1989. 363 pages.

5-A5. Methods for determination of radioactive substances in water and fluvial sediments, by L. L. Thatcher, V. J. Janzer, and K. W. Edwards: USGS--TWRI Book 5, Chapter A5. 1977. 95 pages.

5-A6. Quality assurance practices for the chemical and biological analyses of water and fluvial sediments, by L. C. Friedman and D. E. Erdmann: USGS--TWRI Book 5, Chapter A6. 1982. 181 pages.

5-C1. Laboratory theory and methods for sediment analysis, by H. P. Guy: USGS-TWRI Book 5, Chapter C1. 1969. 58 pages.

7-C3. A model for simulation of flow in singular and interconnected channels, by R. W. Schaffrannek, R. A. Baltzer, and D. E. Goldberg: USGS--TWRI Book 7, Chapter C3. 1981. 110 pages.

8-A1. Methods of measuring water levels in deep wells, by M. S. Garber and F. C. Koopman: USGS--TWRI Book 8, Chapter A1. 1968. 23 pages.

8-A2. Installation and service manual for U.S. Geological Survey manometers, by J. D. Craig: USGS--TWRI Book 8, Chapter A2. 1983. 57 pages.

8-B2. Calibration and maintenance of vertical-axis type current meters, by G. F. Smoot and C. E. Novak: USGS--TWRI Book 8, Chapter B2. 1968. 1 pages.

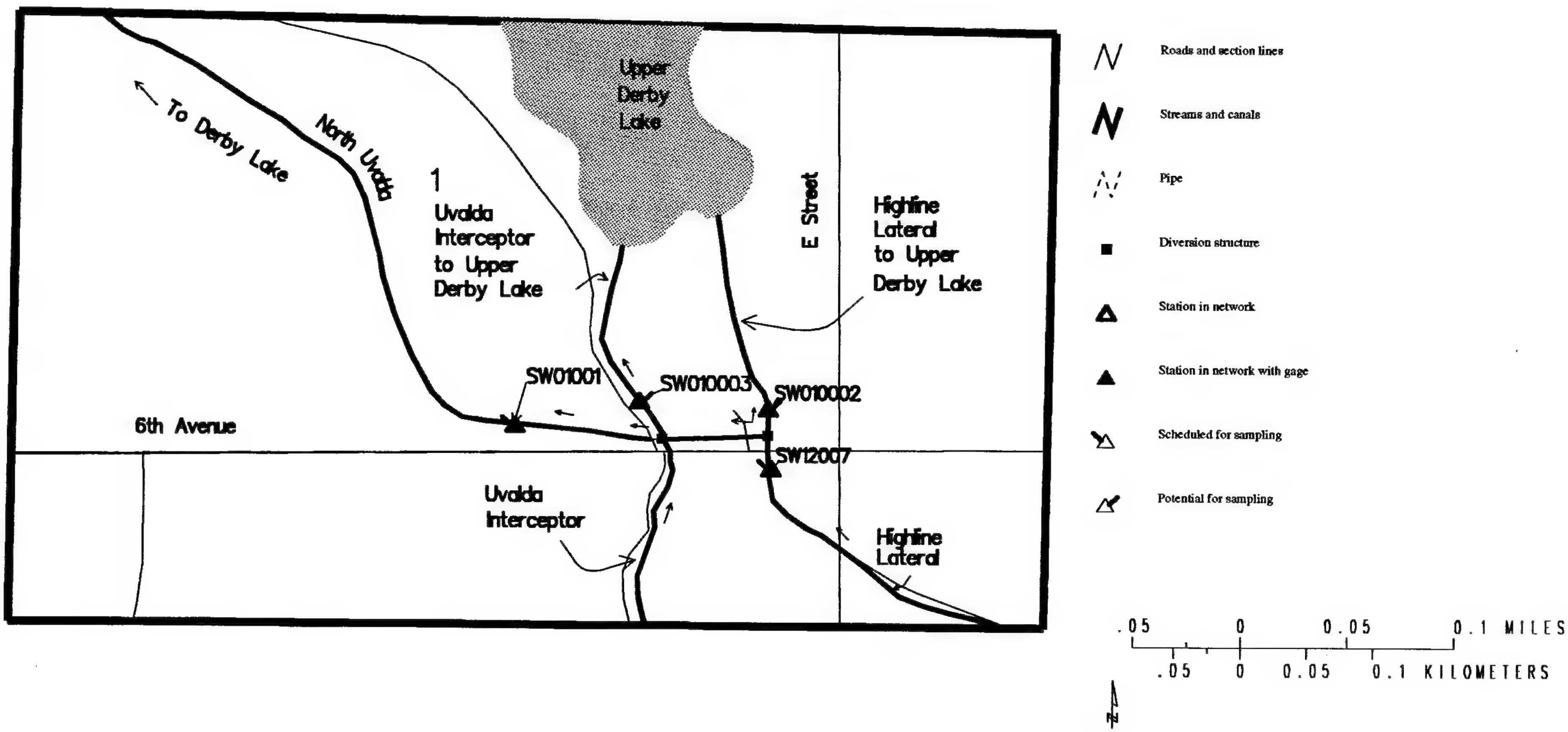


Figure 1.--Detail of the Highline Lateral Gage area.

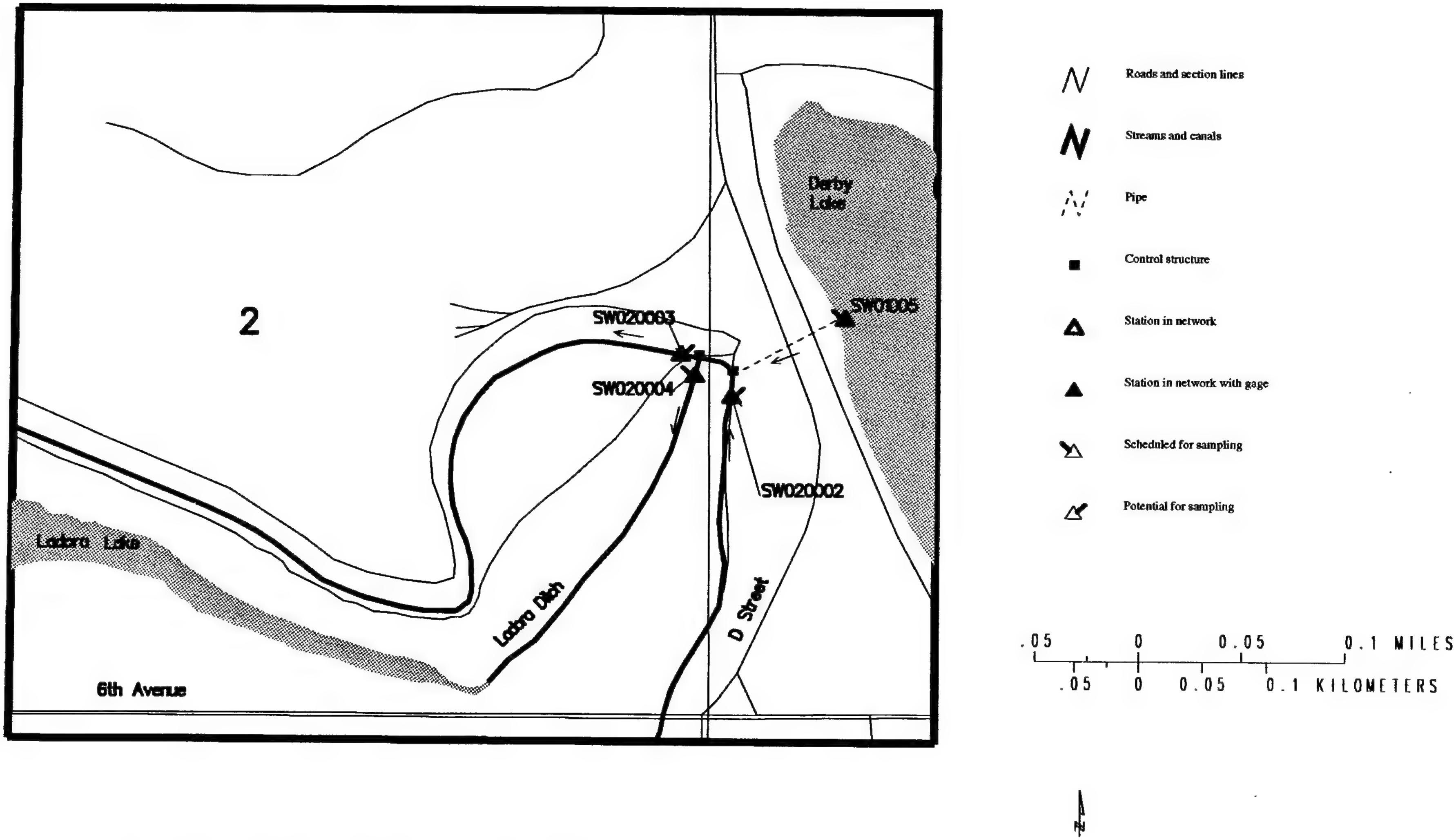
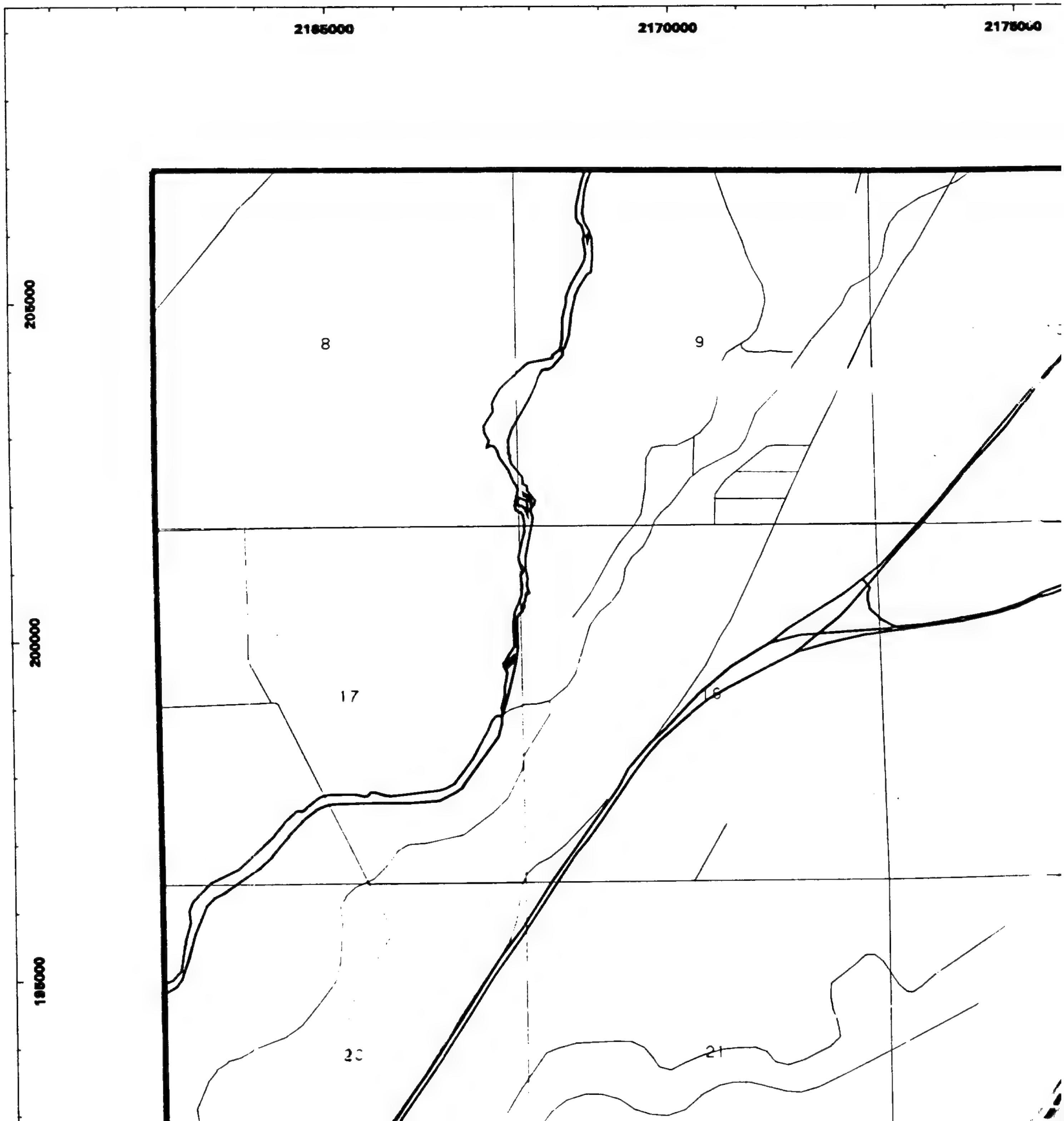
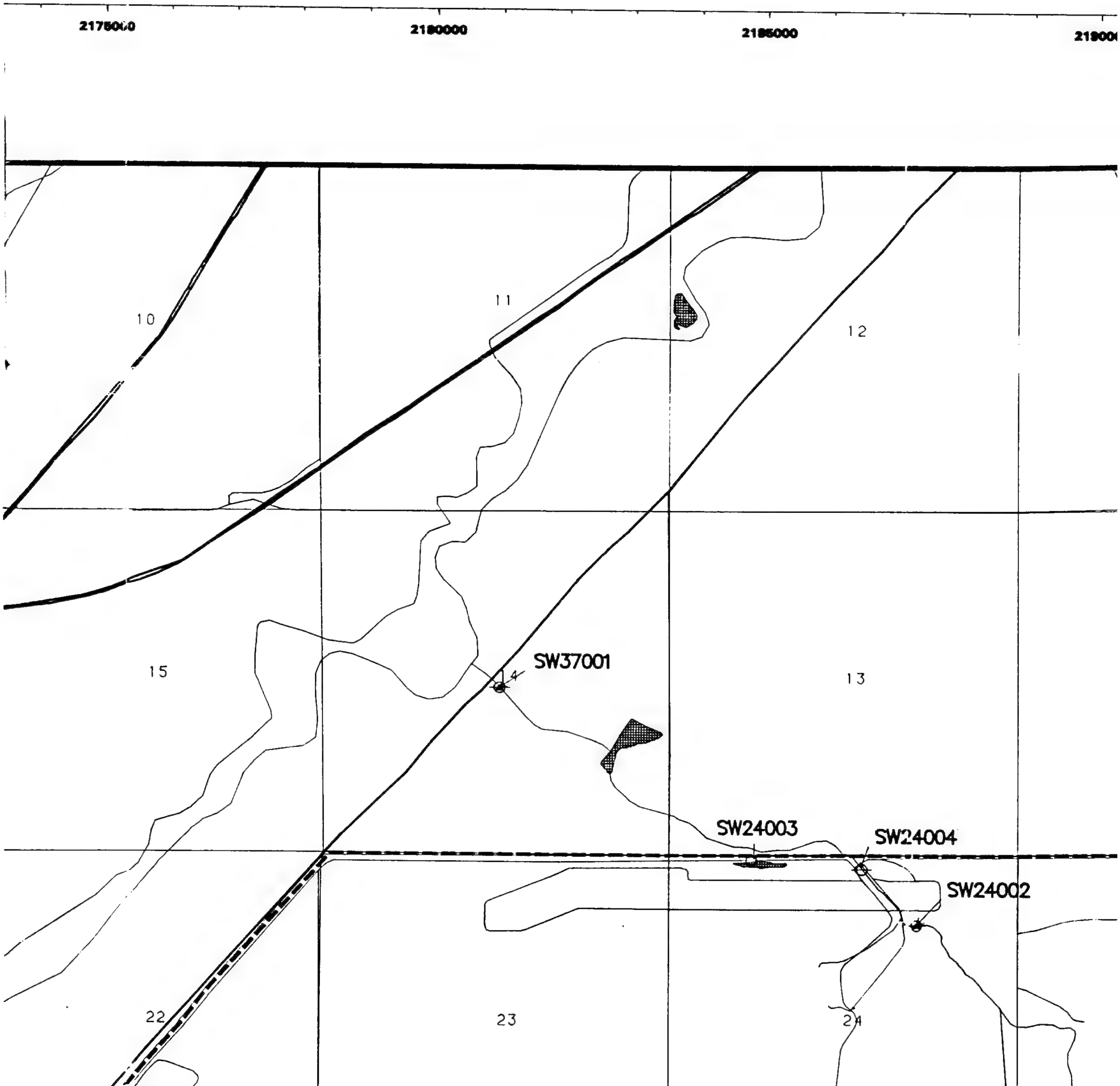


Figure 2.--Detail of the Ladora Weir area.

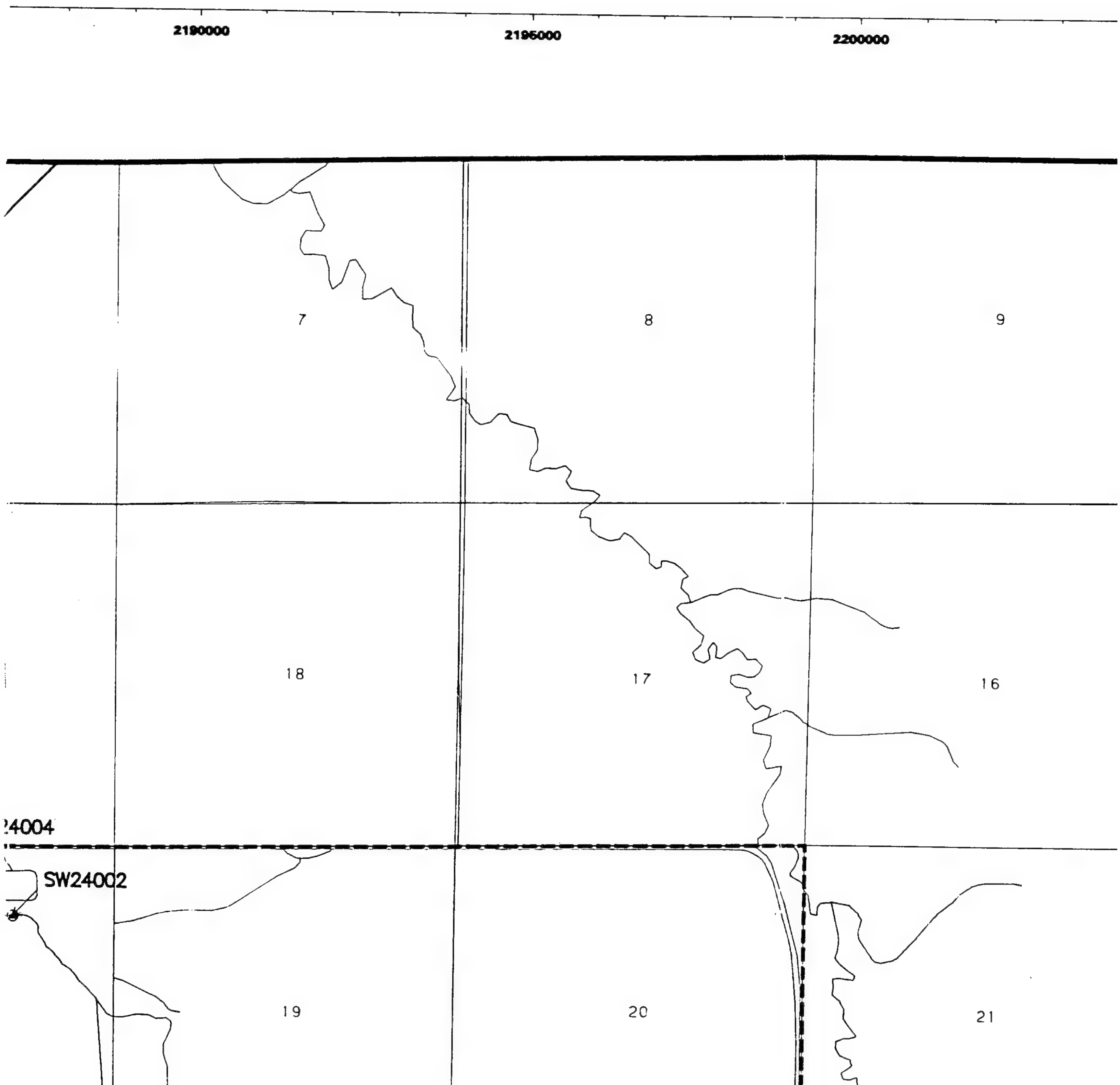
PLATE 1. LOC

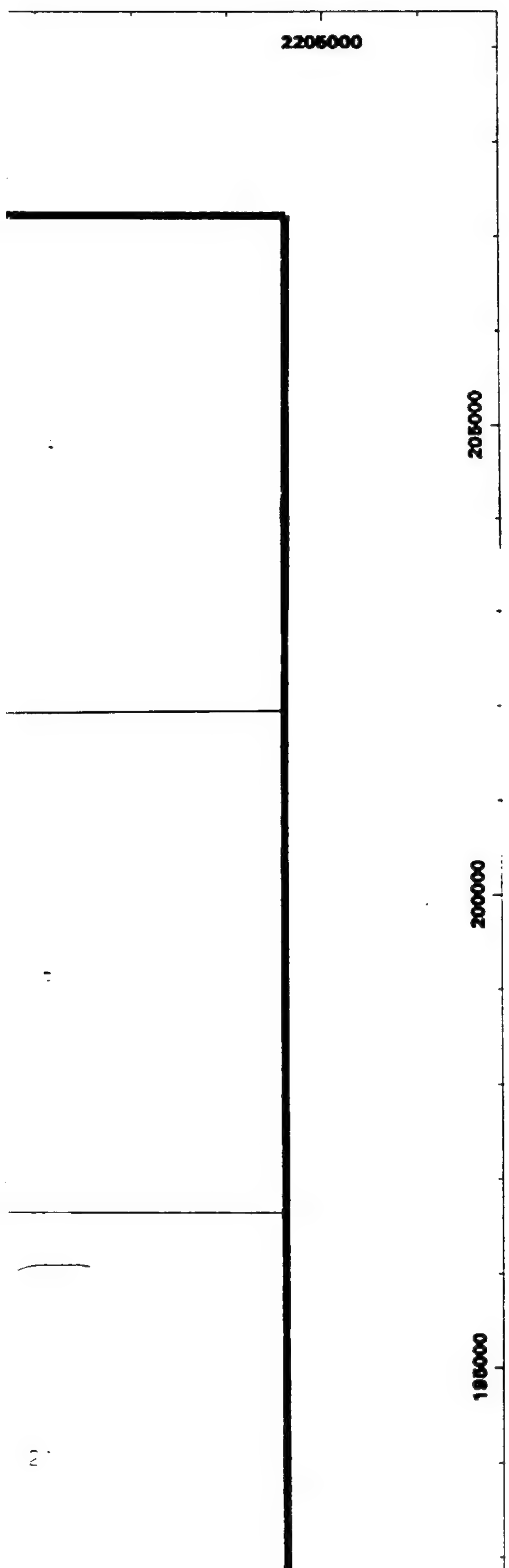


1. LOCATIONS OF MONITORING SITES ADDRESSED BY



ESSED BY SURFACE-WATER PROGRAM.

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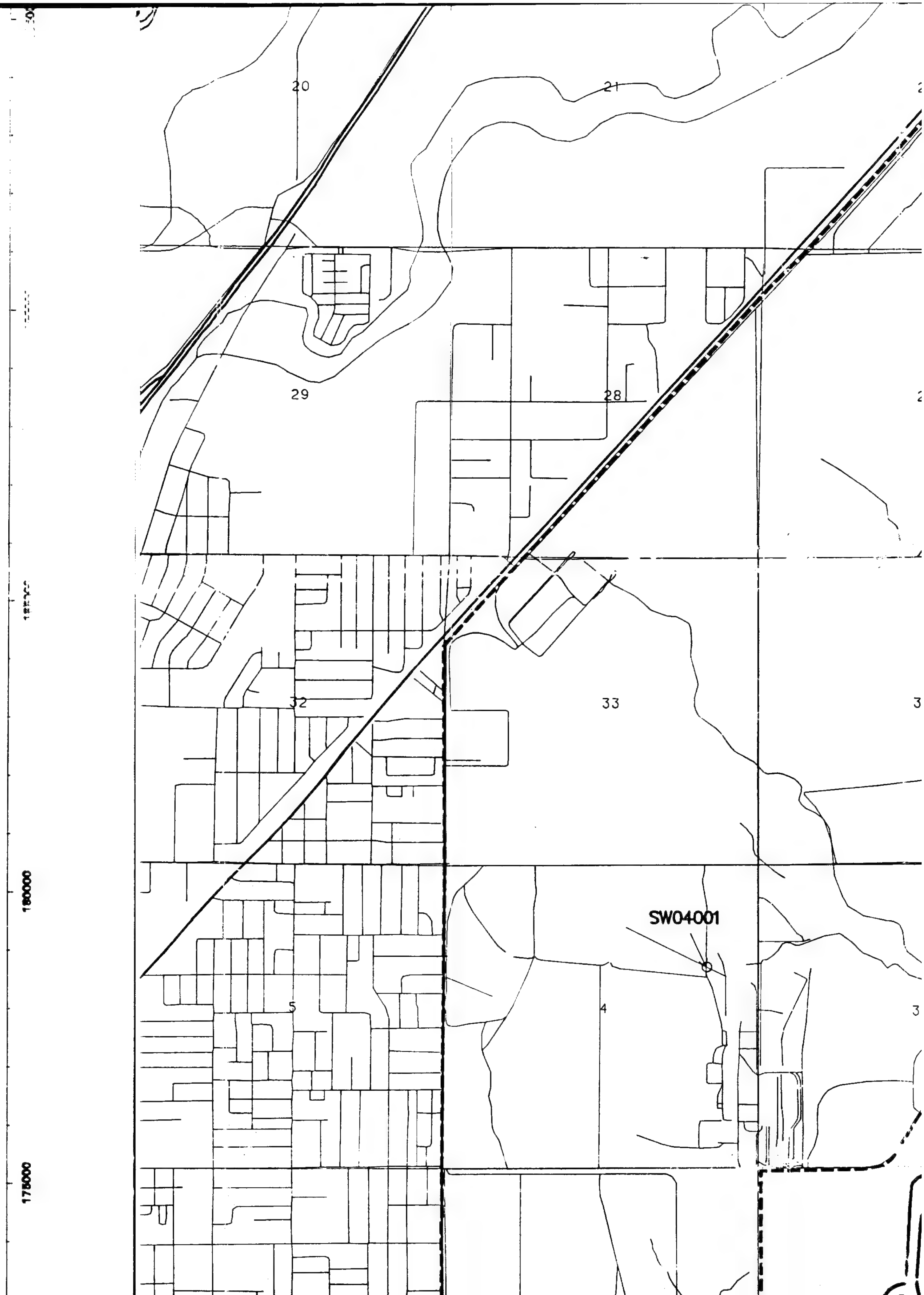
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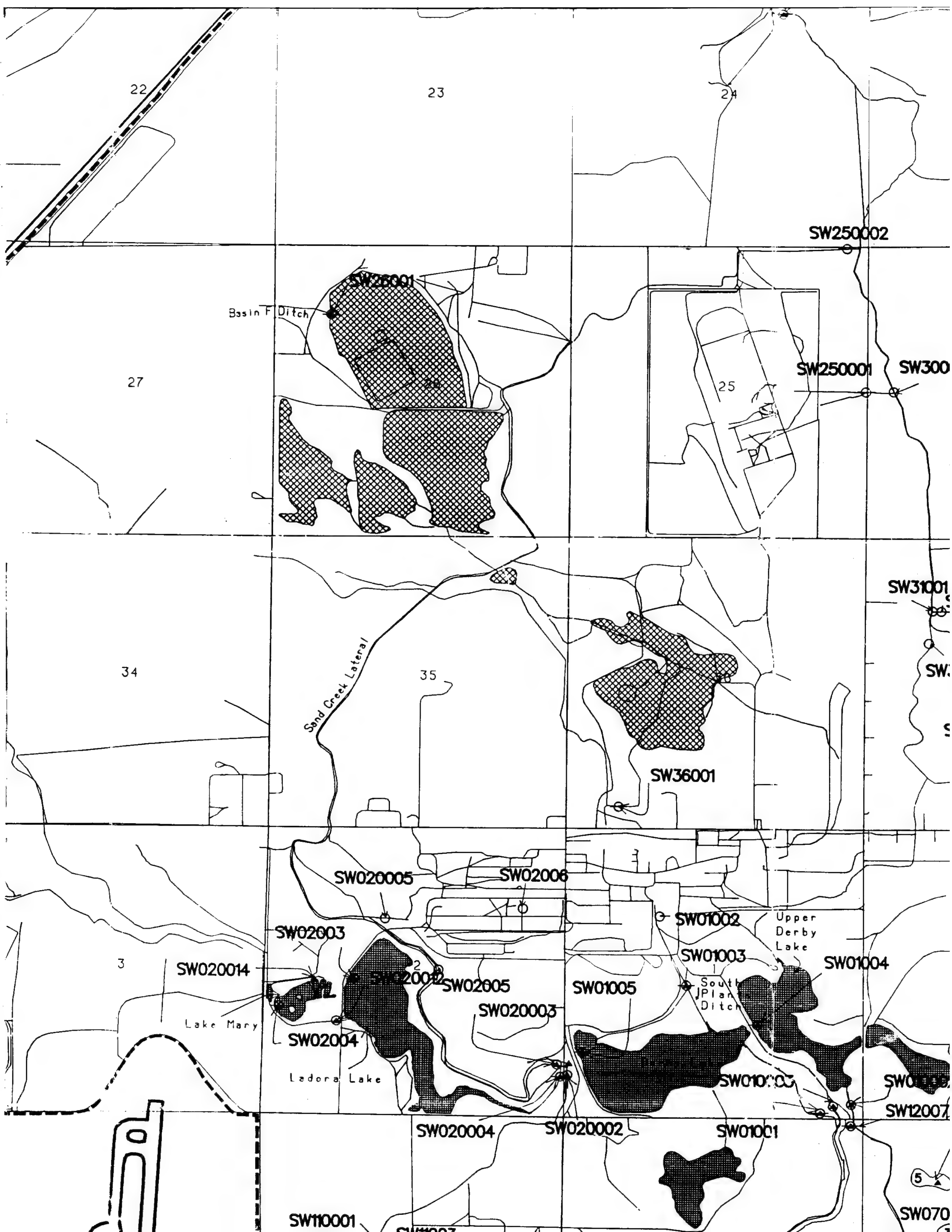
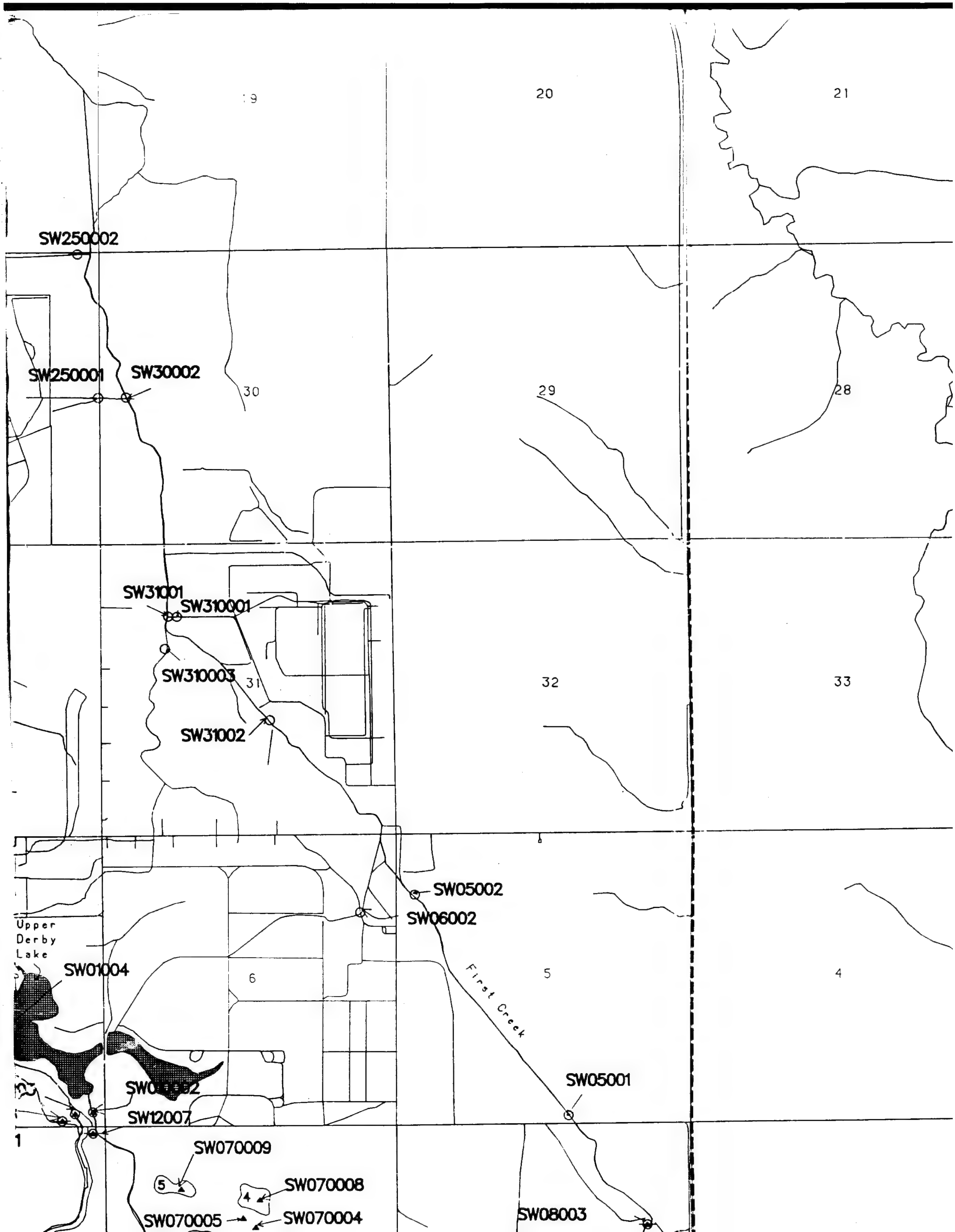
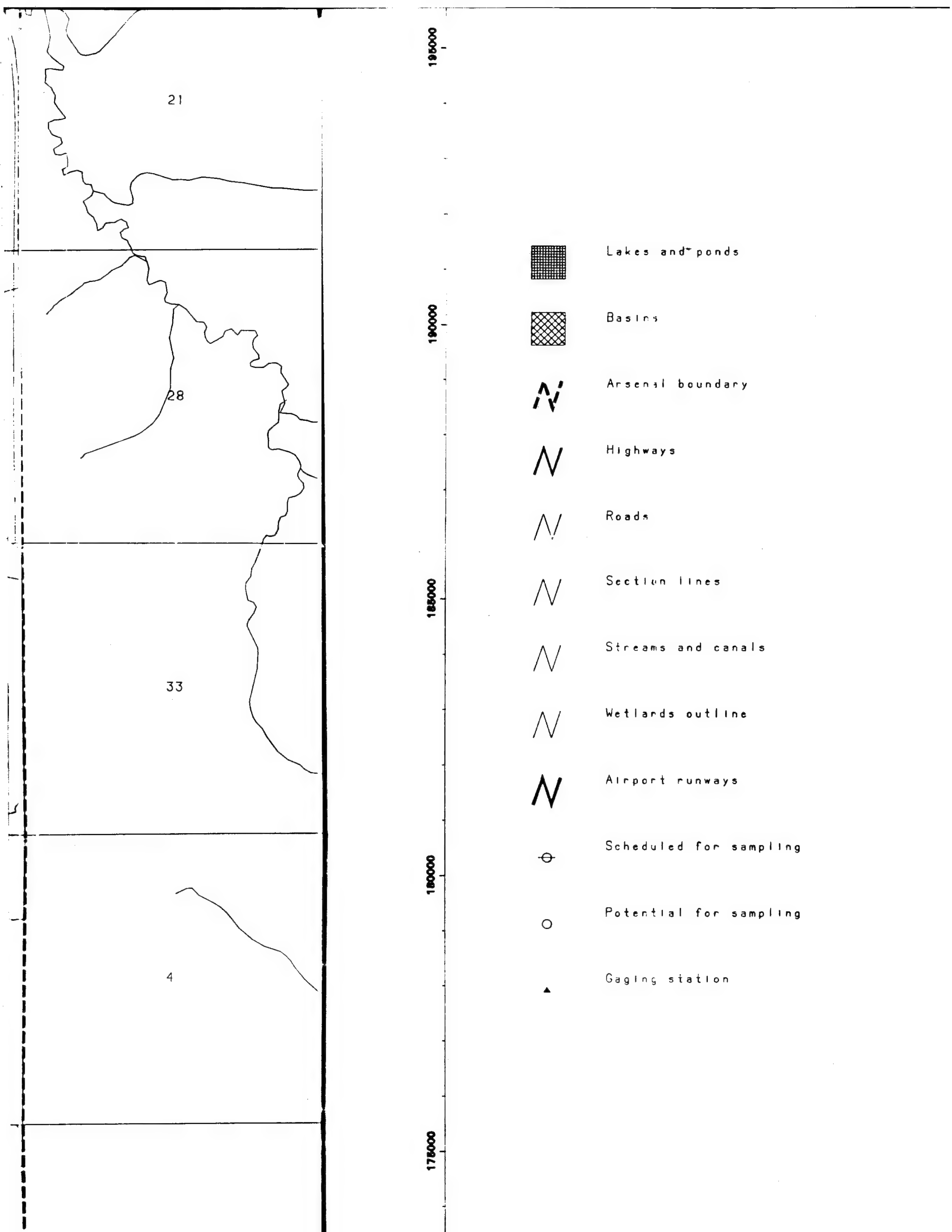
21
29
28
32
33
SW04001
5
4
180000
175000



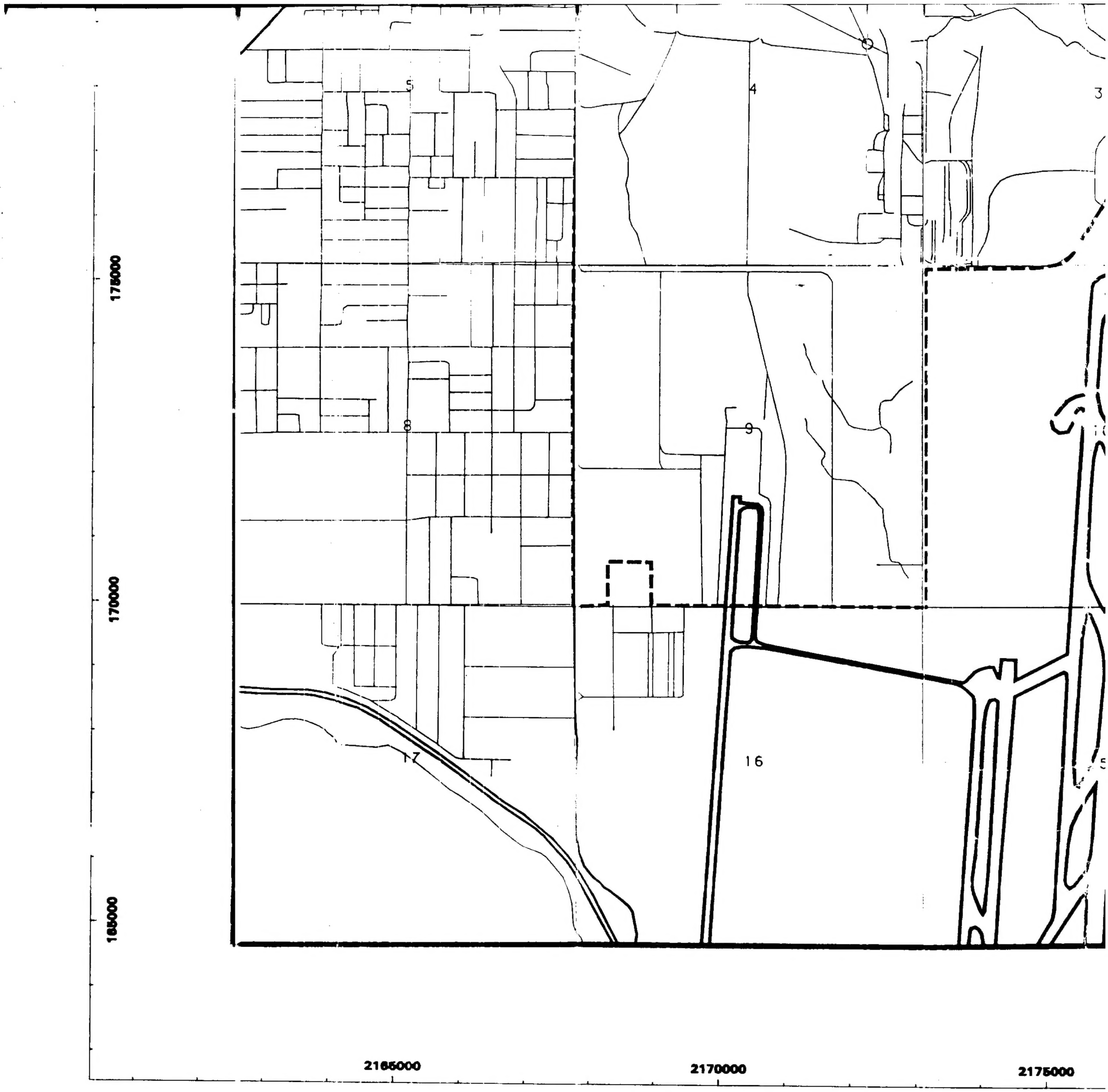
22
23
24
SW250002
SW26001
Basin F Ditch
27
26
25
SW250001
SW31001
34
Sand Creek Lateral
35
SW36001
SW020005
SW02006
SW01002
Upper Derby Lake
SW02003
3
2
SW020014
SW020012
SW02005
SW01003
SW01004
SW01005
South Plant Ditch
SW020003
Lake Mary
SW02004
Ladora Lake
SW020004
SW020002
SW01001
SW110001



20
21
SW250002
SW250001
SW30002
30
29
28
SW31001
SW310001
SW310003
31
SW31002
32
33
SW05002
SW06002
Upper
Derby
Lake
SW01004
6
First Creek
5
4
SW12007
SW05001
1
SW070009
5
4
SW070008
SW070005
SW070004
SW08003



21
28
33
4
195000
190000
185000
180000
175000
Lakes and ponds
Basins
Arsenal boundary
Highways
Roads
Section lines
Streams and canals
Wetlands outline
Airport runways
Scheduled for sampling
Potential for sampling
Gaging station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8
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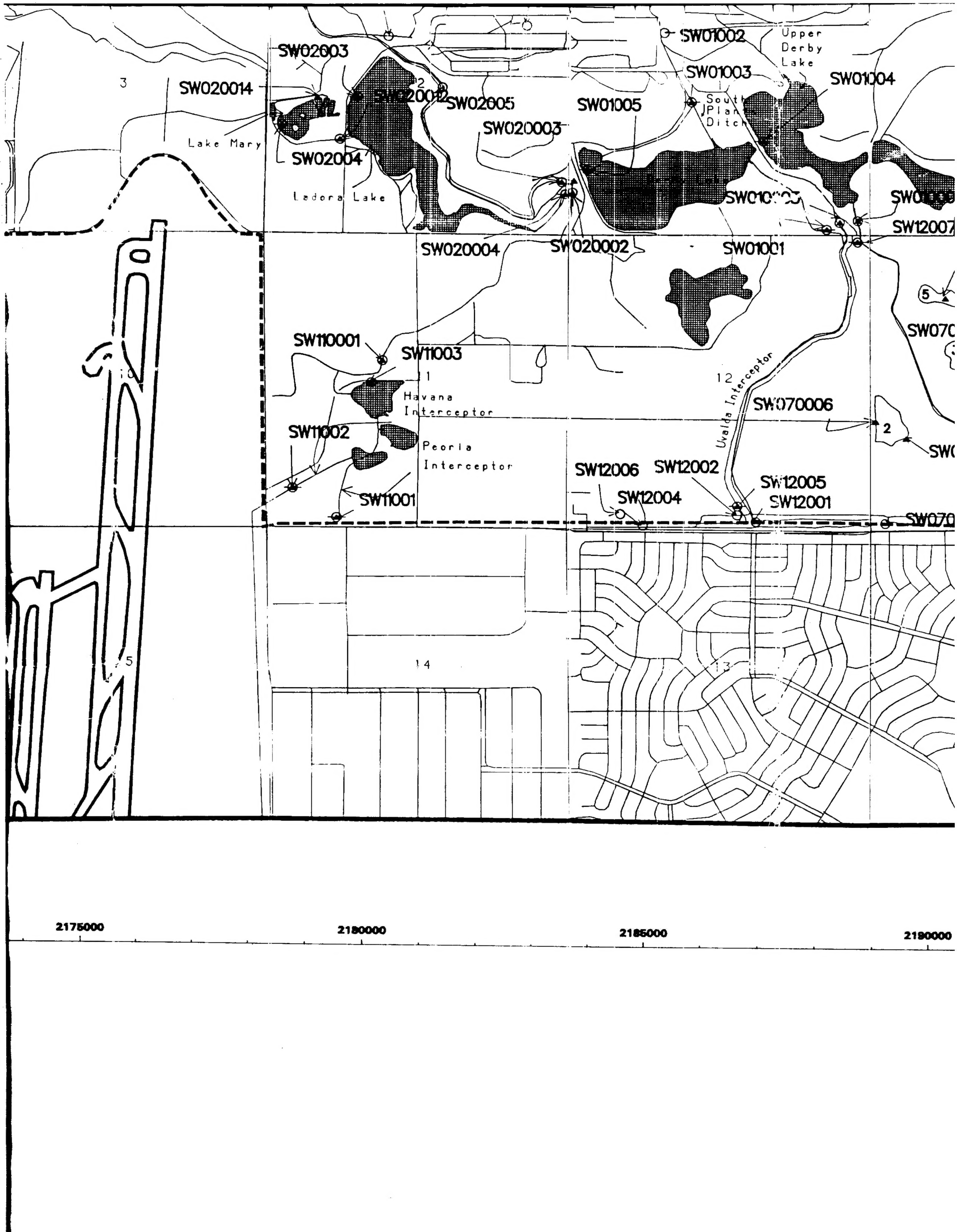
SW01002
Upper Derby Lake
SW02003
SW01003
SW01004
SW020014
SW02001
SW02005
SW01005
South Plant Ditch
SW020003
Lake Mary
SW02004
Ladora Lake
SW020004
SW020002
SW01001
SW12007
SW110001
SW11003
Havana Interceptor
Uvalda Interceptor
SW070006
SW11002
Peoria Interceptor
SW12006
SW12002
SW12005
SW12004
SW12001
SW11001
3
10
11
12
13
14
15
2
5
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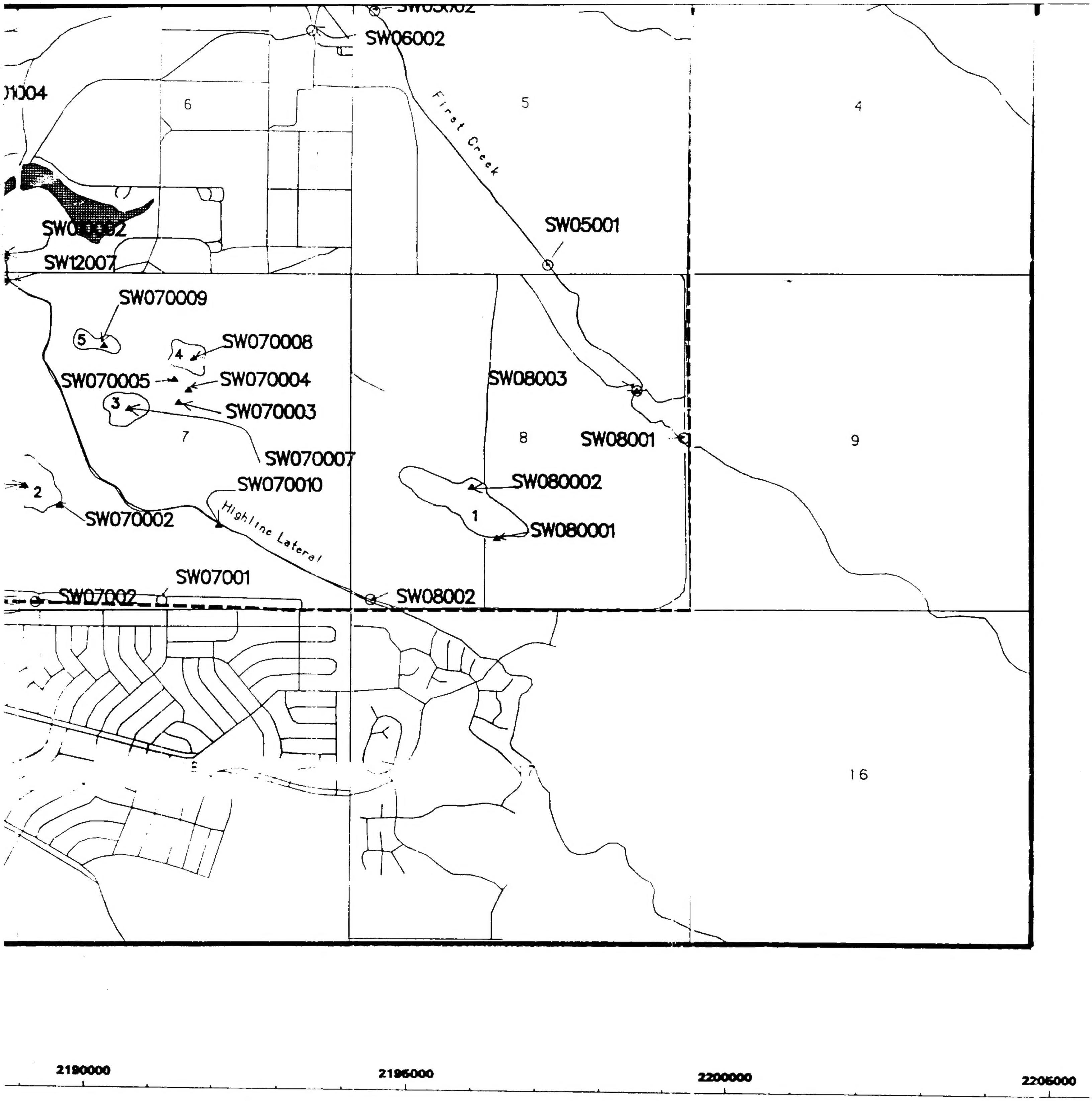

SW06002
6
5
4
First Creek
SW05001
SW12007
SW070009
5
4
SW070008
SW070005
SW070004
3
SW070003
7
SW070007
SW08003
8
SW08001
9
SW080002
1
SW080001
2
SW070002
SW070010
Highline Lateral
SW07001
SW07002
SW08002
16
2190000
2195000
2200000
2205000


Potential for sampling
Gaging station
175000
170000
165000
2205000
1 0 1 MILES
1 0 1 KILOMETERS